

News Briefs

General Developments

Inquiries about News Briefs, where no contact person is identified, should be referred to the Managing Editor, Journal of Research, National Institute of Standards and Technology, Building 416, Room 119, Gaithersburg, MD 20899-0001; telephone: 301/975-3572.

NIST ISSUES STANDARDS FOR CLEANER GASOLINES

A new set of NIST Standard Reference Materials will help ensure that gasoline producers are meeting Environmental Protection Agency and Clean Air Act requirements. Beginning Jan. 1, 1995, the EPA required reformulation of gasolines to reduce ozone pollution from volatile organic compounds in automobile emissions. To comply with the regulation, fuel producers increase the concentration of oxygen in gasolines by adding oxygenates. NIST produced Standard Reference Materials 2286-2293, Oxygenates in Gasoline, to provide industry with a controlled standard to verify the measurement of oxygen in all gasolines produced and sold in the United States. Each SRM contains two ampoules of gasoline with a certified oxygenate concentration and a third ampoule of gasoline with no added oxygenate. For ordering information, contact the NIST SRM Program, Rm. 204, Building 202, Gaithersburg, MD 20899-0001, (301) 975-6776; fax: (301) 948-3730.

U.S. BROKER CHOSEN FOR JOINT EFFORT WITH JAPAN

A partnership headed by the Optoelectronics Industry Development Association of Washington, DC, has been selected by NIST to serve as the “broker” for carrying out the United States’ end of the U.S.-Japan Joint Optoelectronics Project. The two countries are working

to further the design and development of optoelectronics for sophisticated computing technologies that contain both optical components (which transmit and process data using light) and electronic components (which use electrons). Merging optical and electronic technologies offers an evolutionary path toward faster, more versatile computers with an expanded range of applications. The broker is a service that links designers of advanced computer systems dependent on optoelectronic devices and modules with suppliers of such components in research and development facilities in both countries. For more information, contact Judson French, Electronics and Electrical Engineering Laboratory, B358 Metrology Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-2220.

LASER MEASUREMENTS NOW ULTRAPRECISE IN ULTRAVIOLET

Responding to numerous requests from excimer laser users in industry who require accurate and traceable measurements, NIST has extended its laser measurement service to ultraviolet laser wavelengths. NIST now can calibrate power and energy meters for detecting krypton-fluorine excimer laser radiation at a wavelength of 248 nm. Measurements in this wavelength region are needed by users and manufacturers of all excimer laser measurement equipment, and are particularly useful to those working with excimer-based semiconductor photolithography systems. The measurement system was developed and characterized by two NIST scientists. It consists primarily of standard isoperibol calorimeters along with a calibrated fused-silica beam splitter. SEMATECH provided the calorimeters and associated data acquisition system under a long-term loan agreement; it also provided software support to adapt the system to NIST use. For more information, contact Rod Leonhardt, Optoelectronics Division, NIST, Boulder, CO 80303-3328, (303) 497-5162, e-mail: leonhardt@boulder.nist.gov (via Internet).

NIST PHYSICS DATA NOW AT YOUR FINGERTIPS

NIST is now providing researchers around the world with instant access to data through the Internet. The NIST Physics home page provides links to critically evaluated data as well as general information on research and activities. Computer users can access databases that provide atomic and molecular wavelength and intensity information in both tabular and graphic form. Another electronic database provides energy level and transition probability data for a number of elements. Recommended values of the fundamental physical constants also are provided. Users can log in, search by a menu-driven set of commands, and save and retrieve files of data. Also available are extensive bibliographies on atomic transition probabilities and line shape parameters, listings of references to articles on critically evaluated spectroscopic data, descriptions of programs and facilities at NIST, and published Physics Laboratory articles of wide interest. Researchers with Internet-access and World Wide Web browser software, such as Mosaic or Netscape, can link to the NIST Physics Laboratory home page (<http://physics.nist.gov>) or go directly to the Physical Reference Data page (<http://physics.nist.gov/PhysRefData/contents.html>).

ENHANCED FREQUENCY CALIBRATIONS OFFERED

NIST's Frequency Measurement and Analysis Service has been upgraded significantly in resolution, accuracy, and capabilities. It now offers better than 40 ps single-shot resolution (1000 times better than before); one part in 10^{13} uncertainty over 24 h (10 times better than before); and computes shortterm stability using the Allan variance. The FMAS calibrates up to five frequency standards at one time under software control. The new service uses the Global Positioning System instead of LORAN-C, and gives time of day information as well as frequency. Subscribers to the FMAS are provided with all necessary equipment, including a 486-class computer and monitor, GPS receiver and antenna, time interval counter, modem, uninterruptible power supply, tape backup and printer. Also provided are training at NIST's Boulder, CO, site and complete technical support for the service and equipment. The service is useful for complying with National Voluntary Laboratory Accreditation Program requirements. For more information, contact Michael Lombardi, Time and Frequency Division, NIST, Boulder, CO 80303-3328, (303) 497-3212, fax: (303) 497-6461, e-mail: lombardi@bldrdoc.gov (via Internet).

CONSORTIUM REPORT: HOW ELBOWS AFFECT MEASUREMENTS

A newly issued report from NIST's Flow Meter Installation Effects Consortium describes how 45-degree elbows in pipes affect downstream flow meters. Summary Report of NIST's Industry-Government Consortium Research Program on Flow Meter Installation Effects: The 45-Degree Elbow (NIST Technical Note 1408), is the most recent of the consortium's studies. Scientists measured the influence of 45-degree elbows on fluid flow with laser Doppler velocimetry, a light-based technique that can detect flow anomalies without inserting instrumentation into the flow. Conducted at NIST, these studies mark the first such measurements for 45-degree elbows. By understanding how flows behave in such conditions and taking steps to avoid or improve any distortions, fuel buyers, fuel sellers and utility companies could someday realize millions of dollars in savings. TN 1408 is available for \$27 prepaid from the National Technical Information Service, Springfield, VA 22161, (703) 487-4650. Order by PB 95-143061.

TWO BIBLIOGRAPHIES OF EM METROLOGY PUBLISHED

Two NIST divisions have published their annually updated bibliographies, listing all staff publications in outside journals and government reports for the period 1970 to mid-1994. A Bibliography of the NIST Electromagnetic Fields Division Publications (NISTIR 5028) lists publications in the areas of antennas, dielectric measurements, electromagnetic interference, microwave metrology, noise, remote sensing, time domain and waveform metrology. Metrology for Electromagnetic Technology: A Bibliography of NIST Publications (NISTIR 5029) covers cryoelectronics, electromagnetic metrology, laser power and energy, optical fibers and optoelectronics, and superconductor and magnetic material measurements. NISTIR 5028 is available for \$27 prepaid from the National Technical Information Service, Springfield, VA 22161, (703) 487-4650. Order by PB 94-165990. NISTIR 5029 (the last bibliography for the Electromagnetic Technology Division as a whole as the division recently was divided into two groups) also is available from NTIS for \$19.50 prepaid. Order by PB 94-159761.

NIST GUIDE ON MEASUREMENT UNCERTAINTY AVAILABLE

In order to adopt a uniform approach to expressing uncertainty in its measurements, NIST published the first edition of its guide on measurement uncertainty in

1993. Now an updated 1994 edition of Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results is available. The 20-page guide, NIST Technical Note 1297, provides a uniform approach for expressing quantitative statements of uncertainty of NIST measurements. The approach reflects recommendations from the International Committee for Weights and Measures and the International Organization for Standardization. The 1994 edition of the guide includes a new appendix, which clarifies and gives additional guidance on a number of topics related to measurement uncertainty, including the use of certain terms such as accuracy and precision. Single copies of the 1994 edition of TN 1297 are available from the NIST Calibration Program, A104 Building 411, Gaithersburg, MD 20899-0001, (301) 975-2002, fax: (301) 926-2884. Copies also may be ordered for \$17.50 prepaid from the National Technical Information Service, Springfield, VA 22161, (703) 487-4650. Order by PB 95-143087.

VIDEO FEATURES 1994 BALDRIGE AWARD WINNERS

Want to know how the three 1994 recipients of the Malcolm Baldrige National Quality Award make quality management and customer satisfaction work for them? In a new 17-minute video, the successful quality improvement strategies of the three companies—AT&T Consumer Communications Services, GTE Directories Corp. and Wainwright Industries Inc.—are highlighted. The video, "Quest for Excellence VII," is available from the American Society for Quality Control for \$20 plus shipping and handling. Order item TA-022 in ASQC's inventory by calling (800) 952-6587. Videos featuring Baldrige winners from the previous 6 years also are available from ASQC. For use of footage from any of the Baldrige videos, contact Ron Meininger, NIST Public Affairs Division, at (301) 975-2761.

NIST BRIEFS INTERAGENCY GROUP ON NEW PROGRAM

On Jan. 9, 1995, 26 representatives from 15 agencies of the Federal Government were briefed on the National Voluntary Conformity Assessment Systems Evaluation Program. The so-called "NVCASE" program was announced in its final form in the Federal Register as 15 CFR Part 286 in April 1994. NVCASE includes activities related to laboratory testing, product certification, and quality system registration. The program is intended to evaluate and provide NIST recognition to applicant bodies in the United States that effectively demonstrate that their conformity assessment activities satisfy established criteria and applicable regulatory requirements of other countries. NVCASE offers these

evaluation services to support U.S. trade in foreign regulated markets. For NVCASE to work smoothly, NIST needs close cooperation and coordination with affected federal agencies with regulatory responsibilities.

LABORATORY ACCREDITATION

In cooperation with the American National Standards Institute (ANSI) and ACIL (formerly known as the American Council of Independent Laboratories), NIST has helped to form a Laboratory Accreditation Working Group (LAWG) that aims to bring greater efficiency and less redundancy to laboratory accreditation activities in the United States. At the second LAWG meeting, in December 1994, task groups reported on the needs of the various parties at interest, including laboratories, their customers, accrediting bodies, and the governmental and private-sector agencies that require accreditation. A steering group composed of the task group chairs and the three co-sponsors was established; it plans to convene sessions for all those interested in each of the task group areas, to be followed by a plenary meeting at which proposals for a permanent organization, such as a National Conference on Accreditation, will be considered. To ensure broad consensus, each of these meetings will be publicized widely, including announcements in the Federal Register, the ANSI Standard, and relevant technical journals.

ENERGY-RELATED INVENTIONS PROGRAM RECOMMENDATIONS

NIST recommended several innovative technologies to its DOE partner under the Energy-Related Inventions Program. The technologies recommended for November and December 1994 include:

- Improved Cadmium Electrode for NiCad Batteries—a process for producing a new battery that could represent an advancement in battery design for electric vehicles. The inventor proposes producing cadmium fibers to be used in the manufacture of matted cadmium fiber electrodes for nickel-cadmium batteries. The result could be an increase in maximum charge-discharge rates of NiCad batteries over present battery design.
- Hydro-Pneumatic Apparatus for Harnessing Ultra-Low-Head Hydropower—a system to be used for small-scale on-site power generation. This submersible unit is designed to harness low-head water power. Two submerged chambers opposite one another, alternately fill and empty water through gates at the chamber bottoms. The air in these chambers is pumped through a turbine housed midway in a duct connecting them. As one chamber fills and

compresses the air, the second chamber empties of water, drawing on the downwind side of the turbine, thus operating the turbine. As the second chamber fills with water, the first chamber empties and the cycle is completed. The unidirectional turbine designed by the inventor assures that the direction of rotation is constant regardless of the air flow. A private power company holds exclusive development rights and plans to construct and install a full-scale prototype at one of two sites, with field testing to begin in early fall 1995. The company expects the commercial potential to be even greater in developing countries.

- Method and Apparatus for Energy-Efficient Drying—a process for batch or continuous drying of material using superheated steam derived from the moisture evaporated from the wet material. The batch dryer could be used in such industrial applications as the drying of ceramics, laundry, timber, and masonry; the continuous dryer could be used in drying paper, agricultural, and textile products, and for drying of such waste products as sewage sludge and recycled paper. An innovative design feature for the continuous dryer is the way in which the steam and ambient air atmospheres are separated by means of a stratification layer, eliminating the need for mechanical seals.

SPECIAL TESTS SUPPORT NEW TREND IN INDUSTRY'S USE OF TRANSFER STANDARDS

Top-of-the-line instruments, such as precision digital multimeters (DMMs), are changing the way in which industrial laboratories maintain electrical standards. Instead of calibrating discrete standards, like a set of standard resistors, for example, a high-quality, precision DMM with the requisite resolution and short-term stability can serve as a transfer standard for multiple electrical quantities, including ac and dc voltage and current as well as dc resistance. The potential savings in time and fees for industrial laboratories are not trivial: industrial laboratories can schedule a single precision DMM for calibration instead of a number of discrete standards, then use it to calibrate their less accurate DMMs or the outputs of their less accurate multifunction calibrators—saving time and money all along the line. Precision DMMs also are being proposed as transfer standards for assessing the measurement capability of an organization seeking laboratory accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP), both in terms of proficiency testing and for periodic audits.

Therefore, to support what amounts to a new way of doing business, NIST offers special tests for ac voltage measurements: NIST Test No. 53200S for High Accuracy Digital Multimeters and Multifunction Calibrators (by rearrangement). These tests often can entail as many as 250 test points on a given instrument, providing a comprehensive coverage of the functions and ranges available on most precision DMMs and multifunction calibrators. The cost of this service can be as much as \$10,000 (expected to drop to \$5000 in the near future), but this cost compares very favorably to a cost of \$30,000 to \$40,000 for testing an equivalent combination of discrete voltage, current, and resistance standards. Of course, the corresponding uncertainties for the DMM parameters may not be quite as low as for the uncertainties obtainable with discrete standards.

To complement the NIST Test No. 53200S, NIST is now offering a new 25-point special test for calibrating the most often used ranges of precision DMMs. The new test provides customers with NIST uncertainties approaching those available for the 53200S tests, plus the rapid turnaround and reduced cost more commonly associated with highly competitive industrial laboratories. As noted in the NIST Calibration Services Users Guide, the cost for this test is only \$750, and it can be performed with a 1-week turn-around time.

MAGNETIC CALIBRATION FACILITY COMPLETED FOR NAVY PRIMARY STANDARDS LABORATORY

The installation of the magnetic field calibration facility at the Navy Primary Standards Laboratory (NPSL), San Diego, CA, was completed by a NIST scientist. Navy personnel were trained in its operation at both NPSL and at NIST. The NPSL now has the capability to calibrate dc magnetic field measuring instruments from microtesla to 1.4 tesla based on nuclear magnetic resonance (NMR) measurements, which makes their calibrations traceable to NIST. Three axis Helmholtz coils and a precision Pyrex solenoid provide 0.1 % measurements to about 0.1 mT and 0.001 % measurements to about 1.2 mT, respectively. The Helmholtz coils compensate for and reduce the effect of the Earth's magnetic field when using the precision solenoid. Another set of Helmholtz coils can be used for the 1 mT to 10 mT range with 0.1 % capability. An electromagnet and NMR system provide much higher precision for the 40 mT to 1.4 T range. The completed transfer of this system ensures that U.S. dc magnetic field calibration needs can be met by NPSL since NIST no longer provides this service.

GASEOUS ELECTRONICS CONFERENCE DRAWS ATTENDEES FROM AROUND THE WORLD

The 47th Annual Gaseous Electronics Conference (GEC), which was held at NIST, was attended by about 340 scientists and engineers from around the world. The GEC is an annual topical conference of the American Physical Society, Division of Atomic, Molecular, and Optical Physics, that is focused on basic phenomena and plasma processes in ionized gases, and on the relevant theory and measurement of basic atomic and molecular collision processes. The GEC has, in recent years, become a primary forum for discussion about the physics and chemistry of plasmas used for electronics materials processing such as silicon etching and thin-film deposition. At this year's GEC, there were special sessions on plasma displays, diamond-film deposition, and innovative plasma applications. The "GEC reference rf reactor," presently in use at NIST and in many other laboratories around the world, was the outgrowth of a special session held at the 1988 GEC. A meeting of the GEC Users Group was held at this year's GEC.

The GEC reference reactor has become an important tool in evaluating plasma diagnostic methods and for validating theoretical models for low-temperature rf discharges of the type used for processing materials. Fifteen papers were presented at the GEC by NIST scientists. Nine NIST laboratories were included in the technical tours given on the last day. In conjunction with the GEC, meetings were held of the National Research Council Committee on Data Bases for Plasma Processing in which scientists from NIST play a significant role.

DISPLAY MATERIALS CONSORTIUM WORKSHOP

NIST recently hosted a Display Materials Consortium Workshop at its Boulder facility. This university/industry consortium, sponsored by the Advanced Research Projects Agency (ARPA), was established in October 1993 to develop vertical cavity surface emitting laser (VCSEL) materials and devices that emit across the visible spectrum; fabricate VCSELs into arrays; and to establish a production base for these materials and devices. The purpose of this workshop was to develop standardized testing protocols for VCSEL sources, thus promoting the transition to actual production use in display related systems.

NIST recently began a 3-year ARPA funded project to develop standard measurement methods for VCSELs primarily in the areas of beam profile, intensity noise, timing jitter, modulation response, and crosstalk effects for VCSEL arrays. As a result of the overlapping interests of the NIST project and the consortium, NIST was asked to participate in the workshop and future consor-

tium activities. At this meeting, NIST scientists discussed their VCSEL measurement systems and plans with the consortium members. The workshop participants also began the development of a standard measurements document, which was organized into the following categories: electrical (e.g., threshold current); thermal (e.g., junction temperature); beam quality (e.g., mode content); optical (e.g., linewidth); and modulation characteristics (e.g., intensity noise). The NIST participants agreed to help with the continuing development of this document and to research existing standards from such sources as the International Electrotechnical Commission and the Telecommunications Industry Association.

SURGING THE UPSIDE-DOWN HOUSE: BRINGING TOGETHER THEORY AND REALITY FOR MORE RELIABLE ELECTRONIC APPLIANCES

Few sophisticated PC users begrudge the time or money spent to acquire appropriate surge arresters for their home and office communication systems because they need to know their data and equipment are secure. But, are they really safe from damage? A NIST scientist is working with staff at the Power Electronics Applications Center (PEAC) in Knoxville, TN, to address this concern as well as others. Under a technology transfer contract, researchers are surging an "upside-down" house to bring together theory and reality, get a better answer for consumers, and pave the way toward more reliable electronic appliances.

In many homes, electronic appliances, such as facsimile machines, personal computers with modems, and cable-fed televisions are connected simultaneously to two different types of service systems: the electric power system and the telecommunications system, which includes telephone lines and television cable. This arrangement makes them vulnerable, i.e., more likely to be damaged by surge voltages than less complex appliances, such as microwave ovens, which are only connected to a single system. The fact is that even if the power input and the communications input associated with a PC system are each outfitted with some type of surge-protection device, a surge event may cause differences of voltage to occur between the two systems. To identify and quantify precisely what happens during a surge, a representative configuration of the circuitry in a residence has been set up in the PEAC laboratory, according to U.S. practice. There, under the guidance of NIST, circuits have been hung from the laboratory ceiling to decouple them from nearby metallic masses and get them out of the way of laboratory personnel, hence the nickname "Upside-Down House" given to the replica.

To evaluate the threat of impinging surges in an actual installation, surges of various types, as defined in standards covering ac power circuits and communications, were injected at various points in the replica's circuits. Combinations of surge-protective devices were also placed at various locations, corresponding to a variety of real-world exposure scenarios. Concurrently, a numerical model of the wiring was developed with the Electromagnetic Transient Program for the equivalent parameters of the circuit, as measured in the real "Upside-Down House." Surges of various waveforms were then simulated by the model, producing a set of responses that can be compared to the oscillograms recorded in the replica. For instance, surges with peaks of 4000 V were observed across the inputs of a modem-equipped PC. The two sets of results agree, validating each other and making it possible to predict accurately the occurrence of harmful surge voltages and, more important, effective ways of protecting the appliances against these real-world scenarios.

LOAD CELL TESTING: OILM R60

At the request of the NIST Weights and Measures Program, the United States National Conference on Weights and Measures, and the U.S. load cell manufacturing industry, the NIST force group has completed the modifications of its testing facilities to be able to offer type evaluations tests on load cells used in weighing systems in accordance with the International Organization for Legal Metrology Recommendation for Load Cells, OIML R60. The group also ran intercomparison tests to assure equivalent results with another highly respected European national laboratory. As a result, the NIST Weights and Measures Program, which manages the National Type Evaluation Program, has requested that the NIST member to the U.S. International Committee for Legal Metrology designate the National Type Evaluation Program as the U.S. issuing authority for an International Organization for Legal Metrology Certificate for load cells, R60, based upon the results of tests to be conducted by the force group.

This certification is essential as load cells cannot be used in systems that fall under the purview of the Organization for Legal Metrology unless they have first received type evaluation certification. While U.S. manufacturers could obtain type evaluation certification by submitting their prototypes to the national laboratories of other nations, this often resulted in unreasonable delays, sometimes amounting to several years, with the attendant loss in the ability to compete in world markets, especially in the European Common Market.

NIST AND PRIVATE COMPANY ESTABLISH A JOINT PROCESS PLANNING INTEGRATION R&D EFFORT

A collaborative research and development agreement with a private company was recently signed by NIST. The private company is a process planning software system vendor who agreed to work with NIST in a program to advance manufacturing systems integration technology. The program's objective is to facilitate the transfer of NIST-developed technology and information to the private sector and to advance the current state of CAD (computer-aided design) and CAPP (computer-aided process planning) interoperability through integration of CAD systems and CAPP systems. The joint project will investigate how a process planning system can be integrated with design, production scheduling, simulation, and database management systems using technology being developed and tested at NIST.

ISO TECHNICAL COMMITTEE 201 ON SURFACE CHEMICAL ANALYSIS MEETS

The International Organization for Standardization (ISO) formed Technical Committee (TC) 201 on Surface Chemical Analysis in November 1991. After plenary meetings in Japan and Europe in 1992 and 1993, ISO/TC 201 met for the first time in the United States at Golden, CO, on Oct. 20-22, 1994. Three NIST staff members participated in these meetings.

A large factor in the interest and participation in ISO/TC 201 is the growing awareness and use of ISO 9000 Quality Systems, both in the United States and in other countries. ISO/TC 201 will prepare international standards itself; consider national standards, such as those generated by ASTM Committee E-42 on Surface Analysis, as potential international standards; and will similarly consider draft documents submitted by its three liaison organizations.

The 1994 meetings of TC 201 and its seven subcommittees and 15 working groups were attended by 50 delegates, with representation from 8 countries. Each subcommittee and working group has started to develop draft international standards; to date, six proposals for new standards have been approved as work items. The following examples show the range of efforts:

- Procedures will be drafted for measuring spectral parameters needed for obtaining elemental concentrations in Auger-electron spectroscopy and x-ray photoelectron spectroscopy.
- Standards will be prepared that will recommend methods for specifying spectrometers, sources of electrons or x rays, detectors, and important system properties of AES and XPS instruments.

- Procedures will be developed for calibrating uniformly doped materials against certified reference materials, for using uniformly doped materials as secondary materials, and for checking the reproducibility of dopant concentrations determined by secondary-ion mass spectrometry (SIMS) and for comparing SIMS measurements of boron concentrations with those based on electrical-resistivity measurements.
- Procedures will be drafted for determining the thickness and elemental composition of zinc-based binary-alloy coatings by glow-discharge optical emission spectrometry.
- Standards are being drafted for data formats for data transfer and data storage.

CAREFUL RE-EVALUATION LEADS TO NEW RADIOACTIVITY STANDARD

Carrier-free ^{209}Po solution standards recently have been prepared and calibrated and will be disseminated by NIST as Standard Reference Material SRM 4326. Solution standards of polonium isotopes are very popular and among the most frequently requested radioactivity standards. They are used primarily as calibration standards for alpha-emission rate measurements and as low-level tracers and separation yield monitors in radiochemical procedures for analyzing environmental and geophysical samples. For example, assays of ^{210}Po are used for monitoring the nuclear fuel cycle and for investigating the geochemistry and radiohydrology of the uranium-radium decay chain in nature. During the course of the ^{209}Po calibrations, some inexplicable early findings led to a major re-evaluation of the ^{209}Po decay scheme and to a systematic evaluation of the calibration methodology, which was based on liquid scintillation spectrometry. The results are described in articles in *Applied Radiation Isotopes*, the *NIST Journal of Research*, and *Nuclear Instruments and Methods*.

PROCESS CONTROL FOR MANUFACTURE OF POLYMER COMPOSITES

A process control algorithm has been developed that uses the signal from an evanescent wave optical fiber fluorescence sensor to optimize the manufacture of polymer composites by liquid molding. The development addresses a key barrier in the rapid, low-cost manufacture of composite parts for structural applications and is, therefore, of great interest to a wide range of industries, including the automotive companies. The optical fiber sensor measures the degree of cure and resin flow-front position in the mold and provides the input to

control algorithms designed to stabilize the process in response to disturbances including bath-to-batch resin-variation, tool aging, and preform nonuniformities. The optical fiber sensor is incorporated into the fiber preform that becomes the reinforcement in the finished product and employs an optically transparent and high refractive index glass (SRM 711) that allows the fiber sensor to be used in a surface-sensitive geometry (evanescent wave) to obtain information about the critical fiber/matrix interfacial region. The chemical state of the resin is probed by a fluorescent molecule dissolved at low concentration into the resin.

A model-assisted feedback control algorithm has been developed to use the cure sensor signal to control the chemical reaction rate. Since the chemical reaction rate cannot be directly manipulated, the cure controller is cascaded to the base-level temperature controller. The algorithm is quite general and can be linked to any cure sensor that provides the degree of cure. Even more general control algorithms are under development, including non-linear model predictive control, and optimization space gradient search methods.

RESONANTLY AMPLIFIED NEUTRON WAVES IN THIN-FILM RESONATORS AND THEIR APPLICATIONS

Researchers at NIST have, for the first time, demonstrated resonantly amplified neutron flux in a thin-film resonator. This amplified flux can be used to characterize buried layers of certain metals in thin polymer films, and in carrying out grazing-angle diffraction experiments in thin films.

Due to their quantum-mechanical nature, neutrons can behave like waves. These neutron waves can be amplified in a resonator and propagate in a waveguide analogous to the propagation of electromagnetic waves. Because of the short wavelength of neutrons, as compared to light or microwaves, neutron resonators can be made of thin films a tenth of a micrometer or less in thickness, which is typical of the films used in research and industrial applications. NIST scientists have shown that the neutron flux in such resonators can be at least 30 times larger than the incident neutron flux. Theoretical calculations suggest that this flux enhancement can in principle be made much higher. The thin films that enhance the neutron flux—or thinner layers embedded in them—then can be studied with greater sensitivity. For example, neutron diffraction from the surface of crystals or thin films is a subject of very active research in the United States and Europe. However, because of low neutron fluxes currently available, such experiments suffer from weak diffraction intensities.

NIST researchers have demonstrated that the resonantly enhanced flux inside the thin-film resonator gives rise to significantly higher grazing-angle neutron diffraction intensities. These results advance the capability of using neutrons to study surface properties of polymer, metallic, and superconducting thin films in a way not previously possible.

NIST DELINEATES EFFECTIVENESS OF FINE WATER SPRAYS AS FIRE SUPPRESSANTS

Fine water sprays offer potential for controlling fires in data processing equipment, an environment historically protected using halon 1301. The use of halon 1301 is now being sharply curtailed due to its deleterious effect on stratospheric ozone. NIST scientists have now determined how a fine water spray compares in effectiveness to a gaseous agent, CF₃H. Using an array of mock circuit boards in a simulated electronics cabinet, they examined the limitations imposed by the different transport phenomena associated with droplet vs. gaseous dispersion. They measured the impact of the nozzle geometry on extinguishing efficiency, its location relative to the fire, the water application rate, and the amount of shielding surrounding the fire within the cabinet. The water pressure was found to have a significant effect on the size of the region in which a fire can be effectively suppressed. With a severe, but typical, degree of shielding of a burning circuit board, extinguishment was only possible at the highest water pressure, with the fuel on the centerline, and with at least 40 % of the cabinet open to the spray. By contrast, similar fires in all geometric configurations were extinguished successfully with the gaseous agent. This work was sponsored by the U.S. Fire Administration.

NIST MODELS BUBBLE FORMATION IN BURNING MATERIALS

When thermoplastic materials burn, numerous bubbles form below the exposed surface. As these bubbles expand and rise, they spurt gaseous fuel, potentially resulting in accelerated combustion. NIST scientists have developed a three-dimensional, time-dependent model for this phenomenon: the behavior of multiple spherical bubbles expanding in a heated matrix whose viscosity is a strong function of temperature. When the Reynolds number is small and the radial expansion dominates, the equation of motion for a single bubble reduces to the Stokes equation driven by a force in the direction of decreasing viscosity. The team identified conditions under which the flow field is well-approximated by the superposition of the flow fields from individual bubbles and have examined the application of this model to the swelling of an intumescent fire-retarded material.

CONSTRUCTION AND BUILDING INDUSTRIES EXPRESS NEEDS

The National Science and Technology Subcommittee on Construction and Building, co-chaired by a NIST scientist, held a construction industry workshop on Dec. 14–16, 1994, in Washington, DC, to provide an industry perspective on the goals for the construction and building industries proposed by the subcommittee. The workshop was attended by almost 70 representatives from residential, commercial, institutional, industrial, and public works sectors of the industry, including owners, designers, builders, insurance, finance, codes, material and equipment manufacturers, construction equipment manufacturers, planners, and academia. White papers on the proposed goals and the five sectors of the industry provided background material for the workshop. Attendees identified the most important goals to the industry as a reduction in delivery time; a reduction in operation, maintenance, and energy costs; increased durability; and a reduction in construction worker illness and injury. The other proposed goals, reduction in occupant illness and injury, less waste and pollution, and greater productivity and comfort in buildings, were of lesser importance. It was agreed that all the goals need to be benchmarked and the benefits of reaching the goals quantified. In particular, reducing first-cost is extremely important for residential construction.

Much of the discussion focused on the removal of barriers rather than the opportunities presented by advances in technology. The Civil Engineering Research Foundation has been contracted to put together an industry plan based on the workshop.

NIST COMPLETES REFRIGERATION CYCLE SIMULATION MODEL

NIST scientists have just completed a general-purpose model for simulating vapor compression refrigeration cycles, CYCLE_D. Because of its generality and friendliness, the model can be used for diverse applications such as preliminary refrigerant screening, system design, and for education and training. The model can simulate systems using up to 38 single-component refrigerants and refrigerant mixtures with up to five components. The model runs in a user-friendly windows environment and allows easy selecting of the working fluid, operating conditions, and several modeling options. Although the model includes a simulation component for compressors, test-developed compressor maps for accurate compressor representation also may be used. Thermodynamic properties calculations are based on REFPROP, a NIST refrigerant database. CYCLE_D will be available shortly from the NIST Standard Reference Data Program as Database 49.

NIST SPONSORS MEETING ON CRYPTOGRAPHIC APPLICATIONS PROGRAM INTERFACES

Growing interest in standards activities to develop a generic Cryptographic Applications Program Interface (CAPI) and the need for convergence were discussed at a recent workshop organized by NIST. Participants shared information and discussed possible coordination of the activities of NIST, National Security Agency (NSA), United Kingdom (UK) Ministry of Defense (MoD), X/Open, standards committees accredited by the American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), and certain commercial vendors. More than 50 representatives from industry and government, including officials from Canada and the United Kingdom, attended the workshop. Most of the participants were optimistic about the success of future coordination efforts and supported periodic information exchanges.

COMPUTER SECURITY GUIDANCE ISSUED

The Secretary of Commerce recently approved two new Federal Information Processing Standards (FIPS) guidance documents on computer security practices. FIPS 190, Guideline for the Use of Advanced Authentication Technology Alternatives, describes the primary alternative methods for verifying the identities of computer system users and provides recommendations to federal agencies on the acquisition and use of technology that supports these methods. FIPS 191, Guideline for the Analysis of Local Area Network Security, discusses threats and vulnerabilities and considers technical security services and security mechanisms. It presents risk management concepts to assist the reader in determining local area network (LAN) assets, identifying threats, and proposing solutions to reduce the risk to the LAN.

GUIDANCE ON OSE PROCUREMENTS PUBLISHED

NIST Special Publication 500-220, Guide on Open System Environment (OSE) Procurements, provides guidance to federal agencies on the acquisition of an organizational OSE infrastructure, including operating system, human/computer interface, software engineering, data management, data interchange, graphics, network, security, and system/network management services, based on implementations of standard application program interfaces, programming languages, data formats, and protocols. Detailing lessons learned in previous federal OSE acquisitions, the document assists program managers and project engineers in acquiring an OSE on which to build flexible, modular systems and applications. Other organizations in state and local

governments, academia, and private industry also may find the information useful in defining computing environments that promote application portability, interoperability, and scalability.

NIST HOSTS LECTURE ON INFORMATION DEFINITION (IDEF) METHODS IN AN OBJECT ORIENTED WORLD

On Jan. 10, 1995, NIST hosted a day-long lecture on the relationship between the concepts of modeling under the object oriented paradigm and the current information definition (IDEF) modeling techniques, as specified in FIPS 183, Integration Definition for Function Modeling (IDEFO), and FIPS 184, Integration Definition for Information Modeling (IDEF1X). The IDEF modeling techniques are used widely in the Federal Government and private industry. NIST sponsored the lecture in response to the interest among IDEF practitioners and IDEF tool vendors in upgrading the IDEF standards to be compatible with object oriented modeling. More than 20 individuals representing private industry, the Federal Government, and academia attended the lecture.

Speakers included a primary developer of the IDEF0 modeling technique, and one of the primary developers of the IDEF1X modeling technique. NIST sponsored their work in researching IDEF and object oriented technology, and the lecture served as the final report on their findings.

NIST COLLABORATES WITH DRUG ENFORCEMENT ADMINISTRATION (DEA) ON MULTI-AGENCY CERTIFICATION AND ACCREDITATION

NISTIR 5540, Multi-Agency Certification and Accreditation (C&A) Process: A Worked Example, presents a case history of a project implemented for the DEA known as Mountain Pass. The goal of the project was to improve the El Paso Intelligence Center (EPIC) information system and related communications and to satisfy EPIC's current and anticipated system needs. EPIC is a multi-agency facility supported by personnel from participating federal agencies. Mountain Pass was certified and accredited by DEA with the participating agencies defining and assisting the certification process and accepting the implemented security features. The document gives lessons learned and practical guidance to federal agencies that perform multi-agency C&A.

GAMS SEES INCREASING RECOGNITION, USAGE

NIST's Guide to Available Mathematical Software (GAMS) was the subject of a front page story in the November issue of SIAM News, the monthly newspaper of the Society of Industrial and Applied Mathematics.

The article, headlined "NIST's GAMS: A Card Catalog for the Computer User," described the mathematical software cross index and virtual repository service provided by the NIST project. GAMS can be accessed on international computer networks using the World Wide Web (e.g., Mosaic, Netscape, Lynx), gopher, telnet, or through its own native client software. The number of GAMS users has been increasing by about 15 % per month recently, with approximately 4600 uses logged in November. GAMS continues to account for more than half of World Wide Web traffic into NIST. Links to GAMS have now began to appear in many mathematically oriented World Wide Web pages worldwide; some 60 such hypertext links in external Web pages of universities, government laboratories, and commercial Internet service providers have been identified.

IMPROVED ENZYME NOT A "WASH OUT" FIGHTING STAINS

Scientists at the Center for Advanced Research in Biotechnology have altered an enzyme found in common soil bacteria to help laundry detergent better tackle tough stains. The bacteria secrete an enzyme, subtilisin, that digests nutrients. Detergent makers have added it to their products for years, but hot water, bleach and water softeners all make the enzyme less effective than it could be. So, CARB scientists have modified subtilisin to better withstand the harsh conditions of a washing machine. By modifying the bacterial genes which code for the enzyme, the scientists removed a high-affinity calcium site on the molecule that was particularly vulnerable to water softeners. In partnership with a corporate sponsor, the engineered subtilisin enzyme is now being tested for performance. CARB was established in 1984 by NIST, the University of Maryland and Montgomery County, MD, as a unique center for government, academic and industry scientists.

NATURE SHARES DATA STORAGE SCHEME WITH SCIENTISTS

A patent is pending on a new NIST developed light-sensitive protein film that could be used for optical computing. Two Russian researchers working at NIST have immobilized bacteriorhodopsin protein in a high-resolution film. Illuminating the film with yellow or blue light produces a reversible color change. Because each rhodopsin molecule responds independently, each can serve as an on/off switch for storing data. A guest researcher from the Russian Academy of Sciences recently found a way to stabilize octopus rhodopsin so that it could be recycled indefinitely. Other NIST researchers are working on ways to modify bacteriorhodopsin to respond to infrared light. NIST also

recently signed a cooperative research and development agreement with the University of Wisconsin for making monolayer rhodopsin films. Through the CRADA, researchers also plan to test the storage and retrieval capabilities of the films. For licensing information, contact Terry Lynch, B256 Physics Building, Gaithersburg, MD 20899-0001, (301) 975-2691, e-mail: jtlynch@micf.nist.gov (via Internet).

NEW PAPER FEATURES USEFULNESS OF CRYSTAL "DISORDER"

Scientists using x-ray diffraction crystallography know that few crystals have ideal diffraction patterns. Most materials exhibit diffuse scattering caused by a number of factors grouped under the name "disorder." These disorders result in a variety of physical properties useful in optoelectronics, semiconductors and hightemperature superconductors. A new paper from NIST in collaboration with the Australian National University, gives a broad overview of the many areas where diffuse x-ray scattering has been important in understanding the structure and function of crystalline materials. Topics covered include alloy systems, simple inorganic systems such as mixed oxides or halides, low-dimensional conductors, inclusion compounds, molecular crystals, macromolecular crystals, and quasi-crystals. For a copy of paper no. 5-95, "Diffuse X-ray Scattering from Disordered Crystals," contact Sarabeth Moynihan, Div. 104, NIST, Boulder, CO 80303-3328, (303) 497-7765, e-mail: moynihan@bldrdoc.gov (via Internet).

PRIVATE COMPANY, NIST TEAM TO CREATE PARALLEL COMPUTING SOFTWARE

Researchers from a private company and NIST scientists are working together to develop software for high-power computing needs in physics on scalable parallel supercomputers. NIST and the company recently signed a 3 year cooperative research and development agreement to write and test parallel algorithms for computational atomic physics. The CRADA partners will apply advanced quantum theory to predict the properties of heavy elements, which often are used in designing products such as mercury-free lamps, x-ray lasers, pollution detectors, catalysts and new materials containing rare-earth elements. As part of the collaboration, the NIST team will have access to NIST's and the private company's parallel computers, and the company will be able to incorporate the NIST codes into application software packages for its parallel computers, including software to predict the properties of molecules containing heavy elements. The jointly developed software will run on the private company's scalable parallel computers, which have multiple central processing units.

MOIST SOFTWARE VALIDATED IN LAB TESTS

Trapped moisture within a building's walls and ceilings can cause popping nails, blistering paint, bowing wood beams, thermally degraded insulation and poor indoor air quality. In 1993, researchers at NIST and at Virginia Polytechnic Institute and State University developed a user-friendly computer program called MOIST that could predict moisture accumulation in building envelopes. With MOIST, users can define a wall, cathedral ceiling or low-slope roof construction, and then vary the type and placement of building materials to minimize moisture accumulation. A new report from NIST, Heat and Moisture Transfer in Wood-Based Wall Construction: Measured Versus Predicted (NIST Building Science Series 173), documents an extensive laboratory verification of the software's accuracy. Using NIST's large calibrated hot box, 12 residential wall specimens (each incorporating different building components) were exposed collectively to steady and transient winter conditions, and steady summer conditions over a 104-day test period. The test conditions promoted the accumulation of moisture. For most of the wall specimens, MOIST predicted a moisture content that was within 1 % of the actual accumulation. A single free copy of Building Science Series 173 is available from Kimberly Whitter, B320 Building Research Building, NIST, Gaithersburg, MD 20899-0001, fax: (301) 990-4192, e-mail: whitter@micf.nist.gov (via Internet). Multiple copies may be ordered for \$19.50 each prepaid from the National Technical Information Service, Springfield, VA 22161, (703) 487-4650. Ask for PB 95-181574. Anyone wishing to join the over 600 current users of MOIST may obtain a free copy of the software from the same NIST contact listed for the report.

WHAT CAN COLD AIR DO? NEW MODEL TELLS ALL

NIST has developed a new software package, available for microcomputers as well as mainframes, that significantly improves the accuracy of models of the low-temperature properties of air and related mixtures of nitrogen, oxygen and argon. The package, labeled AIRPROPS 5.0, was developed for the National Aerospace Plane Project but also has application to the chemical process industry, particularly in the design and operation of air separation plants. To develop the models, NIST made comprehensive, state-of-the-art measurements of pressure-volume-temperature, sound speeds, heat capacities, liquid-vapor equilibria, viscosities and thermal conductivities for the liquid, vapor and gas phases of air. These data were then used to develop and test a significantly improved equation-of-state for air, covering the temperature range from 63 K to 873 K

at pressures to 70 mPa. The new equation is of standard reference quality and should serve in that capacity for the foreseeable future. A model also was developed to calculate the thermodynamic and transport properties of mixtures of nitrogen, oxygen and argon, including two-phase properties. For information on obtaining the computer program, contact W. M. Haynes, Div. 838, NIST, Boulder, CO 80303-3328, (303) 497-3247, e-mail: haynes@micf.nist.gov (via Internet).

TECHNOLOGY PARTNERSHIP COMPLETES SUCCESSFUL TERM

The National Initiative for Product Data Exchange, hosted by NIST, has successfully completed its 3 year mission to accelerate the development and use of product data exchange—a digital technology that shares via computer all of a product's design, manufacturing, and support services information. NIPDE's record of accomplishments include: identifying, documenting and coordinating over 400 PDE projects and activities nationwide; creating an electronic library of PDE information and documents; producing a video on the advantages of STEP (Standard for the Exchange of Product Data)-based software; and providing informational and educational assistance on PDE to industry. The United States Product Data Association has created a National Product Data Exchange Resources Center to continue specific NIPDE programs. For more information, contact Margaret Lew, US PRO, (703) 698-9600, e-mail: NCGA@cup.portal.com (via Internet).

NEW REPORT CATALOGS FROZEN MARINE TISSUES

Since 1987, NIST and the National Oceanic and Atmospheric Administration have been busy building one of the world's most unusual collections—a storehouse of frozen tissue samples from Alaskan seals, whales and walruses. Researchers collect these samples during Native Alaskan subsistence hunts in cooperation with federal, state, and local resource management programs. The archived tissues, 121 samples stored at NIST's National Biomonitoring Specimen Bank in Gaithersburg, MD, provide scientists with a means of monitoring pollution in the Alaskan offshore environment. Chemists analyze the concentration of PCBs, pesticides and heavy metals in a portion of the collected samples. Such analyses help determine whether industrial contaminants from offshore oil and mineral extraction are accumulating in marine food webs. A newly available report provides a detailed inventory of all Alaska marine mammal tissues archived at NIST. Copies of NISTIR 5462, Alaska Marine Mammal Tissue Archival Project: Specimen Inventory, are available for \$19.50 prepaid

from the National Technical Information Service, Springfield, VA 22161, (703) 487-4650. Order by PB 95-171344.

ENERGY-RELATED INVENTIONS PROGRAM RECOMMENDATIONS

During January 1995, the NIST Office of Technology Evaluation and Assessment recommended innovative technologies for commercialization to its DOE partner under the Energy-Related Inventions Program. The technologies include:

- Environ—Dual-Source Heat Pump—a residential heat pump that uses earth-coupled heat transfer coils in series with a standard outdoor air coil in both heating and cooling modes. In the cooling mode, the water desuperheats the compressor discharge and subcools the condensed liquid; in the heating mode, the water transfers heat to the refrigerant through the post heater. The heat pump's performance is improved significantly over conventional air-source heat pumps, while installed costs are essentially the same. The domestic and retrofit markets for the invention are substantial, and there is potential for export.
- A Dual Fuel Conversion System for High Output, Medium-Speed Diesel Engines—a control system and hardware to convert medium-speed two-stroke cycle diesel engines for dual operation, on either diesel fuel or liquified natural gas. Ignition is by a pilot injection of diesel fuel, which consists of about 5 % of the normal amount of diesel fuel, into the air/natural gas mixture just before the top of the compression stroke. About 95 % of the diesel fuel is replaced by natural gas. The system permits switching from diesel fuel that is derived from imported crude oil to domestically produced natural gas. For the domestic railroad industry alone, the result is an estimated 55 million barrels of imported crude oil per year being replaced by domestically produced natural gas.
- Insulation Containment Apparatus (The Ultimate “R”—)an insulation containment system designed to fit around HVAC ductwork and reduce heat loss or gain. The system consists of fiberboard sections that fold into smaller parts to easily fit through limited access openings to the attic. Once in the attic, the sections open and are positioned around the ductwork and filled with loose-fill insulation. The innovative features of the invention are its simplicity and ease of installation. Installation of the invention in certain regions of the country could save an estimated 1.2 million barrels of oil per year.

NIST EMI/EMC METROLOGY WORKSHOP FOCUSES INDUSTRY ON ROADMAP ISSUES

NIST recently hosted and sponsored a two-day event entitled, “EMI/EMC Metrology Challenges for Industry: A Workshop on Measurements, Standards, Calibration, and Accreditation,” designed to provide the basis for a first metrology roadmap for the electromagnetic interference/electromagnetic compatibility industrial community. NIST’s role is to focus this effort.

The workshop participants sought to identify and prioritize advancements needed in EMI/EMC metrology, standards, calibrations, and related topics that are critical to the economic future of U.S. industry. The workshop was designed to provide information that can be used to map an optimum direction for future research and cooperation by industry and government. To accomplish this goal, the workshop was organized into six successive working sessions on aerospace and aircraft, computers and peripherals, motor vehicles, medical equipment, consumer electronics, and telecommunications. Sessions were successive, rather than parallel, reflecting the fact that the approximately 90 participants were likely to have cross-cutting interests.

The workshop concluded with a ballot through which attendees identified the areas they believed to be most important to address. The detailed report is in preparation, but three categories of EMI/EMC activity have emerged: general electromagnetic field metrology; the development of standards, with an emphasis on harmonization of standards; and facilities for measuring emissions and immunity.

NIST SCIENTIST CHAIRS INTERNATIONAL WORKING GROUP ON HUMIDITY MEASUREMENT

Due to the interest expressed by several national laboratories, the director of the Bureau International des Poids et Mesures proposed in 1993 that an ad hoc working group be established under the Comité Consultatif de Thermométrie to organize an international comparison of humidity standards. The need for more accurate humidity measurements in the semiconductor and pharmaceutical industries, where contamination from moisture is critical, and in the paper and textile industries, where energy conservation is correlated with efficient drying processes, was the motivation for this effort.

Because of NIST’s long-established leadership role in humidity measurement and standards, a NIST scientist was selected as the chairman of the working group to organize and preside over an international workshop. Representatives from the national laboratories of Finland (CMA), France (CETIAT), Germany (PTB), Great Britain (NPL), Italy (IMGC), Japan (NRLM), Korea

(KRISS), Netherlands (NMSVL), Poland (COM), Russia (VNIIM), Singapore (SISIR), Spain (INTA), and the United States (NIST) agreed to participate in the intercomparison.

The International Workshop on Hygrometry was held at the Instituto de Metrologia "G. Colennetti" in Torino, Italy, on July 18–19, 1994. Participants discussed their humidity calibration standards and the procedures to be used for the humidity intercomparison. Additionally, the related issues of saturation water vapor pressure formulations, psychrometer coefficients, enhancement factors, primary standards, and international traceability were addressed. The participants were divided into three regions: the European Union, North America, and the Asian-Pacific region. The intercomparison is designed to determine the uncertainty in humidity standards for the participating laboratories and will be performed in two phases. In the current phase, one instrument for each region is compared among the laboratories in that region. The second phase will be the comparison of the three instruments at NIST.

CONTROL STRATEGY FOR TOXIC METAL EMISSIONS

Toxic metal emissions (e.g., lead, cadmium, mercury) are routinely released from high-temperature environments such as smelters and combustors, and in the processing of materials. Many of these toxic metals have high vapor pressure and, therefore, tend to remain in the vapor-phase long after passing through pollution control equipment intended to remove particulates. One potential way of controlling vapor phase concentration and the eventual particle size of the metal containing solid is through judicious injection of a sorbent, similar to the way SO₂ is removed by injection of calcium carbonate in combustors.

A preliminary study conducted at NIST in collaboration with a professor at the University of Cincinnati demonstrated that injection of a silicon source and appropriate temperature control could result in substantial decrease in lead vapor concentration. The injection of the silicon source leads to the formation of lead silicates, a ceramic with very low vapor pressure. This strategy has the advantage of both lowering the toxic metal concentration in the vapor and trapping the metal in a solid particle more easily removed by currently available pollution control equipment.

NIST HOSTS TELEPRESENCE MICROSCOPY WORKING GROUP

On Jan. 11, 1995 scientists from NIST hosted the inaugural meeting of a working group, involving representatives of Argonne, Sandia, and Oak Ridge National

Laboratories, and Lehigh University in addition to NIST, for the development of "telepresence microscopy." Telepresence microscopy is the remote operation of microscope instrumentation by means of computer control through high-speed networks. The working group's objective is to establish effective "real time" control of all the hardware functions necessary to operate complex instruments such as the field emission scanning electron microscope and the analytical electron microscope, and to transmit the resulting images with sufficient speed to permit unencumbered viewing. The successful implementation of telepresence microscopy will permit more efficient use of these high-cost, state-of-the-art microscope resources and will make scientific collaborations much more effective. A distant colleague will be able to "look over the shoulder" to monitor and interact with a microscopy investigation as it progresses. At the most ambitious level of implementation, that scientist will be able to take over complete operation of the microscope from the remote site. Instrument access will be improved by reducing the need to travel to regional microscopy facilities, and instrument efficiency will be increased through the use of "off-peak" hours, which are currently underutilized.

The telepresence microscopy working group established a plan for future cooperative work based upon a telepresence microscopy project now under way at Argonne to establish a demonstration site based upon controlling a scanning electron microscope. NIST and the other laboratory sites will establish networking facilities compatible with the Argonne project to serve as remote testing locations.

NIST SCIENTISTS COLLABORATE WITH SEMATECH TO STUDY CONTAMINATION ON SILICON WAFERS

NIST scientists have been working with SEMATECH of Austin, Texas, to study the detectability of contamination on the surfaces of silicon wafers. Certain elements, especially metals and alkalis, are deleterious to the operation of integrated circuits made from silicon, even if those substances are present only in minute amounts. In one study, a round-robin exercise organized by SEMATECH and ASTM committee F1 on Electronics, the NIST scientists used a technique known as secondary ion mass spectrometry (SIMS) to measure the amounts of sodium, potassium, and aluminum that were intentionally spin-coated onto silicon wafer surfaces at controlled levels. This method was able to detect these elements at surface atom concentrations as low as 10¹⁰/cm², which corresponds to 1×10⁵ of a single monolayer. Another technique commonly used for surface contamination measurements in the semiconductor industry, total

reflection x-ray fluorescence, is not capable of detecting these three important elements at trace levels.

In another contamination study, a SEMATECH scientist supplied pieces of silicon wafers that had been ion-implanted with boron or arsenic to test for aluminum contamination during the implantation process. Aluminum is a major structural component of the implant that may be inadvertently sputter-deposited onto the wafer surface during the implantation process, and then transferred deeper into the silicon by collisions with the implanted boron or arsenic. The NIST scientists used SIMS in a depth-profiling mode to detect surprisingly high aluminum levels that decayed approximately exponentially with depth below the surface. The results were reported to SEMATECH, which will work with the manufacturers of ion implantation equipment to reduce this contamination problem.

OBSERVATION OF LARGE MAGNETIC DOMAINS IN MAGNETORESISTIVE GRANULAR METALS

Using the new high-resolution scanning electron microscopy with polarization analysis facility, researchers at NIST have measured large (100 nm) magnetic domains in cobalt-silver granular metals. It had not been anticipated that granular materials would exhibit such large magnetic domains, since their microstructure was thought to limit magnetic domains to sizes comparable with the grain particle size (less than 10 nm). The discovery of large domains is noteworthy because these materials exhibit the giant magnetoresistance (GMR) effect, which has many potential applications in improved digital data storage. The presence of large domains implies that a significant fraction of the cobalt in these materials does not contribute to the giant magneto resistance.

In collaboration with Johns Hopkins University, NIST researchers investigated the composition and fabrication parameters that lead to the presence of large domains and suggested two alternative models for their origin. The domains may represent correlations among large numbers of isolated cobalt particles, or they may be due to residual cobalt in the silver matrix. A report of this work was scheduled to appear in the March 27, 1995 issue of *Applied Physics Letters*. Research to ascertain the origin of the domains is under way. These results may assist theorists in understanding and predicting GMR effects of new granular metals.

ACCELERATED AGING OF SILK BY GAMMA RAYS AND ELECTRONS

In collaboration with the Department of Conservation and Scientific Research of the Smithsonian Institute's

Freer Gallery of Art, an ionizing radiation method has been developed recently to age silk fabrics intentionally. For certain tasks in art conservation, some custom-dyed new Chinese and Japanese silk fabrics with the proper thread intervals must be matched in appearance and texture as closely as possible to the fine screen art objects under repair. These include an assortment of painted silks from the 12th to 18th centuries. A study at NIST has been made to find the optimum radiation absorbed dose level and dose rate to impart a particular color and patina and to weaken woven warp and web threads of imported silk swatches so as to simulate those appearances in ancient art objects. It was found that a very high dose (250 kGy) and dose rate (>10 kGy/h) of gamma rays or high-energy electrons are best suited to impart the color and consistency for restorative purposes at the museum. Following this joint investigation, large rolls of silk fabric supplied for this project are now being processed at a commercial electron beam facility in New Jersey.

NONCOLLINEAR SPIN STRUCTURES IN $\text{Fe}_{25}\text{Co}_{75}/\text{Mn}$ SUPERLATTICES

The discovery of giant magnetoresistance (GMR) effects in metallic multilayers such as Fe/Cr has stirred great interest within the magnetic recording industry because of the potential applications of these materials as magnetic sensors. Extensive research has proven that the characteristics of the GMR are principally determined by the nature of the magnetic interaction between the ferromagnetic layers, which are typically aligned parallel or antiparallel across the intervening nonmagnetic layers. In contrast, inferential bulk measurements of $\text{Fe}_{25}\text{Co}_{75}/\text{Mn}$ multilayers and trilayers, grown by molecular beam epitaxy at the Naval Research Laboratory, suggest that the magnetic order is noncollinear with a coupling angle between the $\text{Fe}_{25}\text{Co}_{75}$ layers near 90°.

To complement these studies, NIST and NRL scientists have explicitly extracted the depth-dependent magnetization for a $\text{Fe}_{25}\text{Co}_{75}/\text{Mn}$ superlattice using spin-polarized neutron reflectivity. Preliminary analysis of the data indicates that the spins in alternating $\text{Fe}_{25}\text{Co}_{75}$ layers are actually separated by an angle of $70^\circ \pm 5^\circ$ in a small field of 0.009 T, and that the coupling angle slowly collapses to $40^\circ \pm 5^\circ$ as the field is raised to 0.65 T. Further neutron reflectivity studies are in progress to identify the competing magnetic interactions responsible for this anomalous magnetic structure and to extract their dependence on Mn thickness, interfacial roughness, and other structure parameters of these new layered materials.

ULTRAHIGH SENSITIVITY HARD-DRIVE READ HEAD

The development of a new generation of ultrahigh sensitivity read heads for computer hard drives is being supported by a NIST ATP grant to the National Storage Industry Consortium (NSIC), which consists largely of the U.S. hard-disk drive industry. These read heads are based on thin-film magnetic multilayers, known as symmetric spin valves, which act as magnetic sensors (read heads) to read the magnetic bits on the disk. Research in support of NSIC at NIST developed symmetric spin valves with magnetoresistance values (a key figure of merit) of more than 21 %. Now, these films have been fabricated into prototype heads by the largest OEM producer of read heads in the United States, by ion milling to a device size of 2 m by 0.5 m. These prototype heads exhibited a signal strength of 50 mV at a sense current of 10 mA, the largest signal strength ever measured by Read Rite for a read head. Moreover, these prototype heads were not damaged by the large sense current density of $\sim 10^{-7}$ A/cm², which would be sufficient to damage all but the most robust heads. The signal strength is important because the larger it is, the more densely bits can be stored on and read from a disk. The NSIC goal is a read head that can read 1.5 Gbit/cm² media. This NIST accomplishment constitutes an important step toward achieving that goal.

MODEL FOR CYCLIC FATIGUE OF LEAD ZIRCONATE TITANATE

Piezoelectric ceramics are finding increasing use as sensors and actuators. The actuator material, lead zirconate titanate (PZT), will undergo cyclic stressing conditions in service, leading to possible property degradation or mechanical failure. NIST researchers have found that the fatigue behavior in PZT is different from that commonly observed in most ceramic materials. As a result, the reliability of PZT components under cyclic loading cannot be predicted using models designed for isotropic ceramic materials. Experimentally determined curves of stress versus time to failure were combined with a finite-element analysis to obtain models for lifetime prediction of PZT actuators under cyclic stressing conditions. These models have been shown to be in agreement with experimentally observed behavior and can be used by designers to determine expected lifetimes for PZT components under a variety of service conditions.

DEVELOPING A WORLDWIDE CONSENSUS ON BUILDING PERFORMANCE FIRE STANDARDS

NIST participated in the CIB W14 Plenary session in Helsinki, Finland, Jan. 17–20, 1995. CIB is an international organization that performs prestandardization research in areas related to building standards and technology. W14 is the working commission for all research into fire. This CIB group provides key support and prestandardization research to the International Organization for Standardization (ISO) effort under TC 92/SC 4 on Fire Safety Engineering. Participation includes countries throughout Europe, North America, and Asia. The sessions focused on developing a consensus on the means of providing building standards that are goal-based rather than prescriptive and on reaching a consensus on the means of verifying the correctness of models for fire growth and smoke spread in buildings. The development of performance-based building regulations will reduce barriers to international trade in building materials, products, design, and construction by providing objective criteria and means to establish compliance with these criteria that are not proprietary.

The working group charged with reaching a consensus on building performance fire standards is headed by NIST. The United States has a strong interest not only in facilitating this process but also in supporting a common, global approach to such regulation, which will make international markets more accessible to U.S. interests. The focus of the consensus process for fire model verification is based on NIST's fire model and the papers on comparison between numerical models and experimental data, which have been developed at NIST. In addition to providing the leadership for developing the verification process, by providing the benchmark computer code, compatibility with future work done in the United States is ensured.

NIST MEASURES SMOKE AND RADIATION FROM FORCED-VENTILATED LARGE OUTDOOR FIRES

The Marine Spill Response Corp. (MRSC), an industry-funded marine chemical spill response organization, funded a series of fire experiments in December 1994 near Hondo, Texas. The fires consisted of burning diesel fuel floating on water in a 7.6 m by 7.6 m square pan. Forced air, provided by two diesel-powered centrifugal blowers, was fed to opposing sides of the fire.

NIST conducted several measurements during the experiments. Local weather data were recorded prior to and during the experiments. Heat flux transducers, located at ground level, measured the radiation emitted from the fire. Particulate and carbon dioxide concentrations were measured within the smoke plumes of the fires with a sampling package carried by a tethered blimp.

The data will be used by MSRC to determine the effect of forced ventilation on the smoke yield from in situ burning of oil spills. The experiments also served to assess the feasibility of providing large amounts of forced air to a fire in the field.

COMPUTER PROGRAM DEVELOPED FOR PREDICTING SERVICE LIFE OF CONCRETE VAULTS FOR DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTES

A computer program, 4SIGHT, has been developed for the Nuclear Regulatory Commission by NIST scientists for use in predicting the service life of underground concrete vaults used for low-level radioactive waste disposal. While the vaults are intended to be in dry areas, it is important to the NRC to be able to predict how long the vaults could protect their contents from surface water from heavy rainfall or a flood. 4SIGHT reduces the complex problem of analyzing a complete concrete vault by focusing the analysis upon the roof, which is the critical element due to its proximity to the surface. Using symmetry arguments, the analysis is simplified further by reducing the problem requiring only a one-dimensional analysis.

An important feature of 4SIGHT is its incorporation of the effects of the concrete porosity on ion transport due to both diffusion and advection from Darcy's flow. The resulting changes in porosity, occurring from the dissolution and precipitation of available salts in the pore solution, are incorporated into the transport coefficients. The computer program is capable of incorporating synergistic effects such as corrosion of steel reinforcement and acid leaching of soluble salts from the concrete.

UPDATED BLCC PROGRAM RELEASED

NIST's Building Life-Cycle Cost (BLCC) program has been updated to version 4.21-95 and has been released with a newly revised and expanded user's manual. BLCC is a computer program for economic analysis of capital investment projects that are expected to reduce operating and maintenance costs of buildings and building systems, especially those related to energy and water usage. BLCC is the primary reference program for evaluating investments in energy and water conservation

projects in federal buildings. Nearly 5000 copies of this software product are distributed each year. BLCC runs on PCs under DOS. For a brochure on BLCC and related decision-support software for buildings, contact Laurene Linsenmayer, (301) 975-6132.

NIST CONDUCTS FIRST SUCCESSFUL NON-LINE-OF-SIGHT SURVEY EXPERIMENT

The first-ever tests of a prototype non-line-of-sight (NLS) surveying system were recently conducted at NIST by a NIST scientist in conjunction with co-investigators from the Massachusetts Institute of Technology's Lincoln Laboratories. The objective of the research, which is part of the NIST initiative in construction automation, is to develop a standardized system by which the real-time position and orientation of any object on a construction job site—including materials, personnel, and machinery—may be determined, irrespective of the presence of intervening obstacles. Such a capability is a prerequisite to the introduction of autonomous vehicles and machines into the highly unstructured environment of the typical construction job site.

Traditional surveying technologies, such as transits, theodolites, and total stations require direct line-of-sight between stations and additionally are not suited to kinematic position determination. Newer technologies, such as fanning lasers and GPS satellite positioning, can handle kinematic positioning but are severely attenuated or completely blocked by intervening obstacles including foliage.

In order to penetrate engineering materials, a different approach must be used. Research conducted at NIST has indicated that ultrawide band transmission techniques (sometimes referred to as "impulse radar," "spread spectrum SAR," and "base band radar") appear to have the most promise for developing a practical engineering measurement system. Current efforts in the range of 50 MHz to 2 GHz have indicated significant promise for this technology. Preliminary results show that it is possible to locate, via time-of-flight measurements, the position of a receiver beyond a 1 m-thick reinforced concrete wall, or beyond several brick and masonry block walls, and beyond typical interfering stacks of wide flange steel girders, to within 1 m over a 100 m transmission path with a repeatable resolution of 200 mm. The accuracy was shown to be controlled by propagation delays tied to the dielectric constants of the materials that were penetrated, rather than the distance between transmitter and receiver. The fact that repeatable positions were acquired through up to three 1/3 m-thick composite brick and concrete unit masonry walls indicates that there is great promise with this technology.

Activities in 1995 are aimed at honing the accuracy and resolution (by means of fast compensation algorithms) with the goal of eventually developing a working three-dimensional real-time NLS positioning system. Unusual spinoffs outside of the construction metrology area, including the ability to locate firefighters inside smoke-filled buildings, are anticipated.

NIST HOSTS POST-EARTHQUAKE FIRE AND LIFELINE WORKSHOP

NIST hosted the first Post-Earthquake Fire and Lifeline Workshop in Long Beach, CA, Jan. 30–31, 1995. Fire and lifeline experts identified technology development and research needs that could be used in developing recommendations to reduce the number and severity of post-earthquake fires. Experts from fire departments, the fire protection engineering community, and the insurance, utility (gas, water, electricity), and telecommunications industries worked together to recommend the topics and to prioritize them. The workshop's conclusions will be published in a forthcoming proceedings.

NIST "COMMISSIONS" THE AIR QUALITY IN A NEW OFFICE BUILDING

NIST has developed and implemented an indoor air quality commissioning program in the recently constructed Nuclear Regulatory Commission Building in Rockville, MD. While building commissioning efforts are sometimes conducted in new buildings to verify that the mechanical systems are operating as designed, these efforts do not generally include the verification of an acceptable indoor environment for the building occupants. Based on indoor air quality concerns related to new building materials and deficiencies in ventilation system operation during construction and early occupancy, indoor air quality commissioning may become a common procedure in the future. However, no standardized indoor air quality commissioning protocols exist.

The NIST effort was undertaken to identify and understand the issues involved in implementing a commissioning program. This effort consisted of three tasks: evaluating the ventilation system from an indoor air quality perspective, developing a set of environmental performance parameters to characterize indoor air quality in the building, and measuring the values of these parameters in the building during construction and early occupancy. The parameters included ventilation rates, thermal comfort, and indoor concentrations of carbon dioxide, carbon monoxide, formaldehyde,

respirable particulates, radon, and volatile organic compounds. The results of these measurements indicated that these parameters were in compliance with existing standards and guidelines. The products of this study include a unique dataset of building air quality parameters during and after construction and increased understanding of a number of issues that should be addressed in planning future indoor air quality commissioning efforts. The results of this study are a significant contribution to the development of a national effort to perform indoor air quality commissioning in new buildings. The study is described and the results are presented in NISTIR 5586, Indoor Air Quality Commissioning of a New Office Building.

NIST COLLABORATES WITH THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) TO IMPROVE SOFTWARE ENGINEERING

NIST recently signed a Memorandum of Understanding with NASA to work together to improve software engineering practices and standards within the U.S. industrial base. The goals of the agreement are to provide for assurance of high-integrity software systems, assessment of software system technology, and software technology transition. The organizations will evaluate new and emerging software technologies for contributions to system dependability and software reuse and will develop effective mechanisms for transferring promising software system technology and development practices across many applications within the Federal Government and industry.

NIST COLLABORATES WITH THE ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE, REPUBLIC OF KOREA, ON BROADBAND ISDN

Through a Memorandum of Understanding, NIST and ETRI are working together to develop abstract conformance test and interoperability test suites for Broadband Integrated Services Digital Network (B-ISDN) protocols, including the asynchronous transfer mode (ATM) protocol and others under development by the accredited Standards Committee T1 and the ATM Forum. ETRI has assigned guest scientists to work at NIST to develop the test suites. Accomplishments to date include the development of conformance and interoperability test suites for B-ISDN protocols and research on the B-ISDN call control signaling procedures. The work will continue through the remainder of 1995.

FRAMEWORK FOR HIGH INTEGRITY SOFTWARE ISSUED

NIST Special Publication 500-223, A Framework for the Development and Assurance of High Integrity Software, describes basic processes used to develop software and assists developers, assurers, and customers to understand the base activities performed with any technology or life cycle and to select specific tools and methods. Users of the framework may implement these activities in a manner most appropriate to their software application domain. The framework also serves as a starting point for activities supporting the Center for High Integrity Software Systems Assurance established by NIST.

NIST JOINS FORCES WITH THE NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA) ON ELECTRONIC ACCESS TO INFORMATION

NIST Special Publication 500-221, A User Study: Information Needs of Remote National Archives and Records Administration Customers, describes the electronic access study to determine what information and materials were needed by remote users of NARA services and how best to deliver the information. Results of the study, conducted in Nebraska, concluded that NARA must provide electronic resources to maximize opportunities for citizens and organizations to locate and receive needed information.

NEW PUBLICATION FOCUSES ON ANALYTICAL METHODS FOR THE ANALYSIS OF CANCER CHEMOPREVENTIVE AGENTS

NIST Special Publication 874, Methods for Analysis of Cancer Chemopreventive Agents in Human Serum, is a compilation of methods developed and critically evaluated at NIST for the measurement of selected vitamins, carotenoids, and other micronutrients in human serum. These compounds are under investigation world-wide for their efficacy in reducing the risk of developing certain types of cancers. This reference manual was established as a result of NIST efforts in providing consultative services and analytical-measurement quality assurance for 50 laboratories that participate in a Micronutrients Measurement Quality Assurance Program co-sponsored by the National Cancer Institute. This document serves as a means of transferring NIST measurement expertise to clinical laboratories involved in epidemiological studies and clinical trials to establish the cancer-preventive efficacy of these compounds.

Standard Reference Materials

STANDARD REFERENCE MATERIALS 3198 AND 3199—ELECTROLYTIC CONDUCTIVITY

Quality control of feedwater and boiler water is essential to economical power plant operations. Steam generation at high temperature and pressure requires that ionic contaminants be limited to very low concentrations to minimize corrosion and scaling. Electrolytic conductivity is an indicator of ionic contaminants in water, and accurate conductivity standards below 30 $\mu\text{S}/\text{cm}$ are necessary for safe and efficient operation. Inaccurate measurements lead to plant outages caused by scaling and corrosion from condenser leakage, condensate polishing, or make-up water quality equipment malfunctions. Enormous costs may result from inaccurate measurements. As a result, industry and the U.S. Navy petitioned NIST to develop stable reference solutions of low electrolytic conductivity in the range of 5 $\mu\text{S}/\text{cm}$ to 15 $\mu\text{S}/\text{cm}$.

The Standard Reference Materials Program announces the availability of SRMs 3198 and 3199, Electrolytic Conductivity, intended for use in electrolytic conductivity measurements as calibration standards or control samples. These SRMs consist of 500 mL solutions of high-purity potassium chloride (SRM 999) dissolved in a mixture of 30 % by mass 1-propanol and 70 % by mass, deionized water in equilibrium with atmospheric carbon dioxide. High-purity water, which was deionized and filtered through a 0.22 μm filter, was used to prepare the solutions. The 1-propanol used to prepare the solutions was obtained commercially and assayed at 100 %. Electrolytic conductivities of the solutions, at 25 °C, are SRM 3198—4.98 $\mu\text{S}/\text{cm}$ and SRM 3199—14.99 $\mu\text{S}/\text{cm}$.

STANDARD HELPS ANALYZE WHAT'S "DOWN BY THE BAY"

As government and industry increase efforts to safeguard natural resources, U.S. laboratories are facing increased demands for environmental analysis of soil and sediment samples. To help ensure accurate analyses of environmental samples in federal, state, and private laboratories, NIST developed Standard Reference Material 1646a, Estuarine Sediment, for calibrating analytical instruments and evaluating the reliability of laboratory methods for determining major, minor and trace elements in estuarine sediment and similar materials. The SRM contains 50 grams of finely powdered, homogenized Chesapeake Bay sediment. NIST chemists

analyzed the sediment with two or more independent analytical methods. The SRM includes a certificate with values for 19 elements, among which are arsenic, cadmium, lead and selenium. Noncertified values also are provided for 19 additional elements. SRM 1646a is available for \$268 from the NIST Standard Reference Materials Program, Rm. 204, Building 202, Gaithersburg, MD 20899-0001, (301) 975-6776, fax: (301) 948-3730.

STANDARD REFERENCE MATERIAL 2781— DOMESTIC SLUDGE

Domestic sludge, once dehydrated, is often sold as a garden fertilizer. Since the fertilizer may be applied to food crops as well as to lawns and flower beds, the concentrations of toxic heavy metals present, which might be taken up into the edible portion of the crop, must be regulated. This requires analytical quality control through the use of appropriate Standard Reference Materials.

The Standard Reference Materials Program announces the availability of SRM 2781—Domestic Sludge. This SRM is intended primarily for use in the analysis of sludge, or other materials of a similar matrix. SRM 2781 is a dried and pulverized domestic sludge, which was then blended to achieve a high degree of homogeneity. This material was radiation-sterilized prior to bottling. A unit of SRM 2781 consists of 40 g of the dried material. Certified values for nine regulated metals, N, and P in SRM 2781 are based on measurements using two or more independent and reliable analytical methods. Information values are provided for three additional regulated metals and for eight major matrix constituents.

The material for this SRM was obtained from the Metropolitan Denver Sewage Disposal District No. 1 through the U.S. Geological Survey.

STANDARD REFERENCE MATERIAL 930E— GLASS FILTERS FOR SPECTROPHOTOMETRY

Modern “reverse geometry” spectrophotometers, with wavelength dispersion following the filter sample in the optical train, require improved parallelism in the opposite faces of optical filters used to verify absorbance accuracy in spectrophotometry. In such instruments, a deflection of the beam by an optical “wedge” may lead to vignetting of the light by the entry slit of the optical spectrometer, artificially increasing the measured absorbance value.

In response to the need for the glass filters to be used in reverse geometry instruments, NIST has modified the

prior SRM 930d series by improving the optical finish to enhance parallelism. The Standard Reference Materials Program announces the availability of SRM 930e—Glass Filters for Spectrophotometry. This SRM is intended for use in the verification of the transmittance and absorbance scales of spectrophotometers in the visible spectral domain. SRM 930e consists of three individual glass neutral density filters in separate metal holders and one empty filter holder. The exposed surface of the glass is approximately 29×8 mm, measuring from a point 1.5 mm above the base of the filter holder. The filter holders are provided with shutters that protect the glass filters when not in use. Each filter-containing holder bears a set identification number and a filter number (10, 20, or 30), which corresponds to the nominal percent transmittance (100×transmittance) of the filter.

ROUND-ROBIN RESULTS CONFIRM NEED FOR OPTICAL FIBER CONNECTOR SRM

In response to requests from the Telecommunications Industry Association (TIA), NIST recently completed an industry-wide measurement comparison of metal-wire pin gages used to size the bores of connector ferrules. As optical fiber moves from long-haul applications to the local loop, network topologies are requiring many more connection points. There is, therefore, a requirement for inexpensive, reliable means to make fiber-to-fiber connections. The cores of single-mode fibers must be aligned with tolerances of a micrometer or less to avoid unacceptable losses. Ceramic ferrules (hollow cylinders) used in fiber connectors help provide the necessary alignment between fibers plugged in to mating ferrules. The fibers are held in place in the ferrules by epoxy; the fiber ends are convex and actually touch at their centers to form a “physical contact” connection. A keying system prevents rotation so that the fiber ends cannot be ground against each other as the connections are made and unmade. NIST earlier addressed the problem of control of the outer diameter of optical fiber by qualifying and developing measurement methods for this parameter and a Standard Reference Material for fiber diameter.

Six industrial participants measured 18 pin gages with nominal diameters in the vicinity of 125 µm. Measurements were compared against NIST’s contact micrometer; in addition, the pin gages were measured by a second group at NIST. Agreement between these NIST measurements was excellent. Measurements by the other participants, however, exhibited significant spread and offset from the NIST values. These results indicate the need for a calibration standard, and NIST

plans to offer a pin-gage SRM having a diameter of 125 μm . Industry would use the SRM as a master to calibrate go/no-go pin gages for field use. The results of the intercomparison were reported at a recent TIA meeting.

Standard Reference Data

CHEMICAL KINETICS DATABASE FOR PC USERS EXPANDED

Environmental scientists, research chemists, combustion engineers and process chemists can search for data on 9200 chemical reactions in an expanded database now available from NIST. NIST Chemical Kinetics Database Version 6.0 is an important tool for modeling combustion systems or chemical processes occurring in the atmosphere. These data are necessary, for example, in predicting the atmospheric lifetimes of chemicals that may impact on the depletion of the Earth's ozone layer. Chemical Kinetics Database Version 6.0 contains data on 29200 rate constants and 4400 compounds. It lists 7500 literature references. The new version of the NIST Chemical Kinetics Database is available for \$390. Owners of a previous version can update for \$150. To order the Chemical Kinetics Database Version 6.0, contact the Standard Reference Data Program, A320 Physics Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-2208, fax: (301) 926-0416, e-mail: SRDATA@enh.nist.gov (via Internet).

NIST/EPA/NIH MASS SPECTRAL DATABASE/ MICROSOFT® WINDOWS™ RELEASED

Standard Reference Database 1.0—NIST/EPA/NIH Mass Spectral Database for Microsoft® Windows™ is now available from the Standard Reference Data Program. The new interface allows users to perform routine and specialized tasks from a customized workspace in the most widely used mass spectral library in the world. Access to the complete 62250 spectra and 12000 selected replicate spectra library is easier than ever. Seven different data windows can be customized and positioned in building a personal desktop. New search features include a similarity search, which helps users find similar compounds if their unknown is not in the library; special “peak-oriented” searches; and incremental name searches. A very important feature for instrument manufacturers is that the program now reads various spectral formats from commercial systems. This new interface is already generating interest in the analytical community.

Calendar

July 23–28, 1995

50TH CALORIMETRY CONFERENCE

Location: National Institute of Standards and Technology Gaithersburg, MD

Purpose: To report on and discuss topics associated with calorimetry and chemical thermodynamics.

Topics: Enthalpies of mixing non-electrolytes, aqueous electrolyte solutions, thermodynamics and industry, stability and binding of macromolecules, model systems of biological relevance, methods in biothermodynamics, irreversibility in biological DSC, advances in calorimetric instrumentation, calorimetry of nuclear materials, fire calorimetry, and standards in calorimetry. There will be a special session on the history of the calorimetry conference to mark the 50th anniversary of this conference.

Format: Lectures, poster sessions, and discussion groups.

Audience: Researchers and those interested in calorimetry and thermodynamics.

Sponsors: NIST and the U.S. Department of Energy.

Contact: Robert Goldberg, A353 Chemistry Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-2584.

October 10–13, 1995

18TH NATIONAL INFORMATION SYSTEMS SECURITY CONFERENCE *(Formerly the National Computer Security Conference)*

Location: Baltimore Convention Center Baltimore, MD

Purpose: To provide a forum for addressing traditional security concerns, as well as security issues associated with the emerging National Information Infrastructure (NII).

Topics: Tracks on research and development, integration and applications, and management and administration, in addition to a tutorial track. Topics include directions of IT security, network security, viruses, risk management, contingency planning, and privacy. Emphasis on solutions to real-world security concerns.

Format: Five tracks, which provide a combination of peer-reviewed papers and panel sessions, and opening and closing plenary sessions on present subjects and issues of interest and importance to the community.

Audience: A large, diverse national and international audience—approximately 2000 are expected from industry, government, and academia.

Sponsors: NIST and the National Computer Security Center.

Contact: Irene Gilbert-Perry, A216 Technology Building, NIST, Gaithersburg, MD 20899-0001, (301) 975-3360.

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NIST Technical Publications

Periodical

Journal of Research of the National Institute of Standards and Technology—Reports NIST research and development in those disciplines of the physical and engineering sciences in which the Institute is active. These include physics, chemistry, engineering, mathematics, and computer sciences. Papers cover a broad range of subjects, with major emphasis on measurement methodology and the basic technology underlying standardization. Also included from time to time are survey articles on topics closely related to the Institute's technical and scientific programs. Issued six times a year.

Nonperiodicals

Monographs—Major contributions to the technical literature on various subjects related to the Institute's scientific and technical activities.

Handbooks—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications—Include proceedings of conferences sponsored by NIST, NIST annual reports, and other special publications appropriate to this grouping such as wall charts, pocket cards, and bibliographies.

National Standard Reference Data Series—Provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated. Developed under a worldwide program coordinated by NIST under the authority of the National Standard Data Act (Public Law 90-396). NOTE: The Journal of Physical and Chemical Reference Data (JPCRD) is published bimonthly for NIST by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements are available from ACS, 1155 Sixteenth St., NW, Washington, DC 20056.

Building Science Series—Disseminates technical information developed at the Institute on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

Technical Notes—Studies or reports which are complete in themselves but restrictive in their treatment of a subject. Analogous to monographs but not so comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NIST under the sponsorship of other government agencies.

Voluntary Product Standards—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The standards establish nationally recognized requirements for products, and provide all concerned interests with a basis for common understanding of the characteristics of the products. NIST administers this program in support of the efforts of private-sector standardizing organizations.

Order the following NIST publications—FIPS and NISTIRs—from the National Technical Information Service, Springfield, VA 22161.

Federal Information Processing Standards Publications (FIPS PUB)—Publications in this series collectively constitute the Federal Information Processing Standards Register. The Register serves as the official source of information in the Federal Government regarding standards issued by NIST pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 CFR (Code of Federal Regulations).

NIST Interagency Reports (NISTIR)—A special series of interim or final reports on work performed by NIST for outside sponsors (both government and nongovernment). In general, initial distribution is handled by the sponsor; public distribution is by the National Technical Information Service, Springfield, VA 22161, in paper copy or microfiche form.

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